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Adding Nutrients to Enhance Salmon Runs: Developing a Coherent Public Policy[1]

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In 2001 the American Fisheries Society sponsored a well-attended symposium that explored the potential of sustaining salmon production and biological diversity by adding nutrients to salmonid ecosystems (Stockner 2003). Adding nutrients to waters and watersheds, at least based on a cursory look, seems counter to the general public policy of reducing the inflow of nutrients to waters that has been in effect for a half century. In North America, especially during the past several decades, considerable public and private resources have been expended to *reduce* nutrient inputs to aquatic environments. Many nutrient inputs, especially those from point source discharges, have been reduced.

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According to proponents, adding nutrients (popularly referred to as "fertilization") to aquatic environments or watersheds is needed to help restore greatly depleted salmon runs in the Pacific Northwest. Nitrogen and phosphorus are usually considered the key limiting nutrients. Nutrients may be added in the form of raw or processed salmon carcasses or commercially produced organic or inorganic fertilizers. Proponents also argue that many salmon watersheds are now nutrient deficient due to inadequate replenishment from oceanic or other sources, and that an intervention (*i.e.*, fertilization) will be necessary to help restore other, salmon dependent, species.

The scientific rationale (Stockner and Ashley 2003) generally parallels the following line of reasoning:

> *Salmon are a vector by which marine nutrients are captured and conveyed against the force of gravity into freshwater ecosystems. Especially in the upper reaches of watersheds where salmon are able to spawn and their offspring spend their early lives, these nutrients, in both organic and inorganic forms, play an important, perhaps essential, role in maintaining viable salmon runs along with numerous other ecosystem components. For example, a substantial proportion of the nitrogen in plants and animals in streams where salmon are abundant is probably derived from decomposed spawned salmon. This "anadromous nutrient pump" has been attenuated considerably because salmon runs have been reduced substantially in the Pacific Northwest for decades and, in some places, for more than a century. Thus, the addition of nutrients to watersheds, lakes, or streams where salmon runs are now much reduced would replace, at least partially, the "missing" marine-derived nutrients and would likely enhance salmon runs and overall aquatic productivity.*

There are many scientific uncertainties associated with assessing the efficacy of nutrient addition. For example, is it *possible* for salmon runs in the Pacific Northwest to be restored *without* somehow compensating for diminished nutrient inputs? When and where is it most effective to add nutrients to improve spawning and rearing success, thus enhancing salmon runs? What form of nutrient addition is the most effective for restoring runs and minimizing adverse effects? There are many other scientific questions concerning use of nutrients to enhance salmon runs that deserve serious attention, but resolving scientific uncertainties *can* be addressed with a comprehensive, sustained research effort (Lackey 2003).

Equally important, however, are the many important questions *not* amenable to scientific evaluation. For example, is the use of nutrients just the latest techno-fix in the continuing effort to restore salmon, and will it fail, as have the others, because it does not address the root causes of the decline? Because it is a relatively

painless way for society to address the salmon decline issue, will nutrient addition become the tool of choice to avoid the difficult societal actions that would have to be implemented if salmon are to be restored? What criteria should regulatory agencies use to decide which proposals for nutrient addition to approve? How should a government agency justify forcing some members of society (*i.e.*, farmers, ranchers, forest managers, golf course owners, and suburbanites) to reduce their addition of nutrients to streams and lakes, while simultaneously condoning requests from fisheries managers to add nutrients?

The specific policy questions that should be answered, at least implicitly, by the relevant regulatory agencies are:

- *Fundamentally, even assuming that rigorous field tests demonstrate that nutrient addition has the capability of restoring wild salmon runs, is it an appropriate tool for restoration?*

- *Is there an inherent policy conflict between adding nutrients to watersheds to enhance salmon runs and other societal values such as protecting or enhancing water quality, given that society desires both?*

- *Intended or not, will fisheries technocrats lead society again down the track of a quick-fix solution rather than addressing the fundamental causes of the salmon decline?*

- *Is there a regulatory bias toward achieving "distilled water" in lakes and streams such that the important beneficial role of waterborne nutrients (especially nitrogen and phosphorus) will not be appropriately understood and considered?*

- *Should regulatory agencies categorically reject large-scale requests for nutrient addition until its efficacy is adequately documented in scientifically validated field tests?*

- *How should regulatory agencies balance the universally supported, but apparently conflicting, goals of enhancing water quality and restoring salmon through nutrient addition?*

- *If nutrient additions are approved by regulatory agencies, what level of monitoring should be required, if any, to evaluate effects on water quality, and which agency or organization should be responsible for the required monitoring and evaluation?*

- *How much latitude will various levels of government (and society) be granted in deciding to what extent nutrient addition will be permitted, given that local, state/provincial, and national environmental and natural resources priorities often conflict?*

Beyond the relatively narrow constraints of restoring *salmon* runs and maintaining water quality, there are other important policy and scientific issues to consider. For example, is it desirable (perhaps even essential) to add nutrients specifically to rehabilitate key wildlife species (*e.g.*, bears and eagles), vegetation (*e.g.*, to restore the growth rates of trees), and scavengers (*e.g.*, aquatic invertebrates and small mammals)? Although policy and scientific assessments of the desirability of nutrient addition is generally limited to concerns about restoring salmon runs, concurrent with maintaining water quality, other ecological considerations also are important.

There are many concerns that need to be evaluated carefully before environmental protection agencies develop general policies or promulgate specific regulations on granting requests for permits to add salmon carcasses, processed fish products, or inorganic fertilizers to rivers and lakes in the Pacific Northwest. It is easy to be diverted with arguments of the scientific merits of proposals to add nutrients, but there remain, even with *complete* scientific knowledge, explicit policy clashes of competing values that society will adjudicate through the bureaucracy of the regulatory/management agencies or the courts.

Given the intense public commitment to restore runs of wild salmon in western North America, and the likelihood that nutrient addition of some sort will continue to be seriously considered in recovery efforts, the policy challenge for environmental protection and natural resource agencies will be to craft policies that carefully balance the apparent need for nutrient *removal* (at some locations) to enhance water quality with nutrient *addition* (at other locations) to help restore salmon runs.

Literature Cited

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